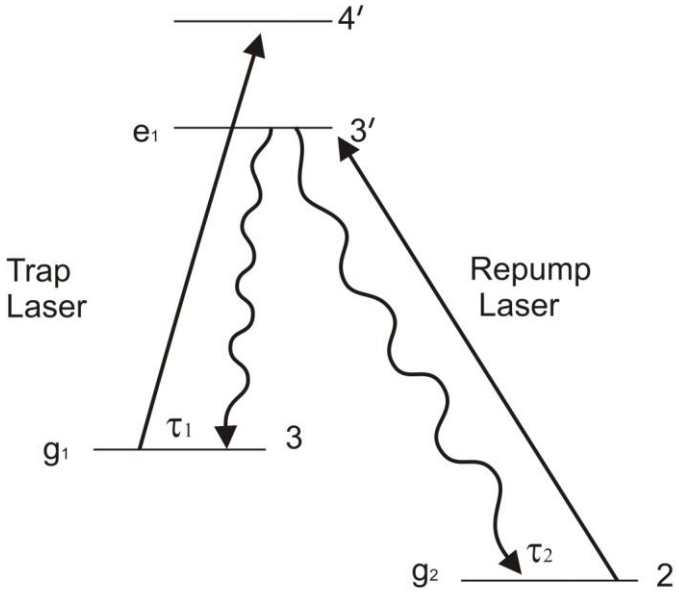
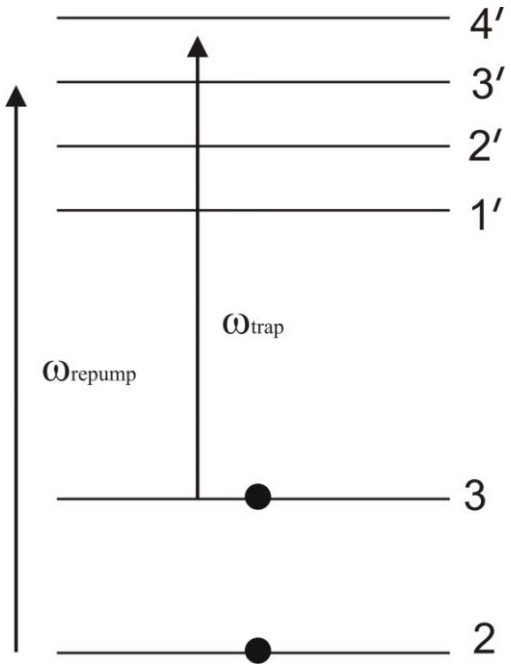
Physics 4062/5062 – Tutorial Nine – Optical Pumping

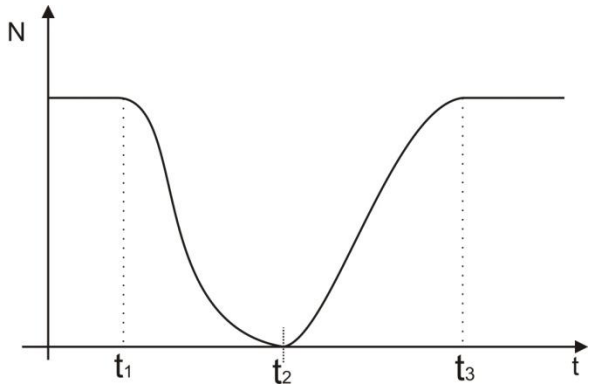
Optical Pumping: After fully loading the trap, the change in atom number N can be recorded as a function of time by turning off either the trap laser or the repump laser. The time constants of the decay can be used to infer the optical pumping time.

Recall role of repump laser:

The trap laser frequency, ω_{34} is ~ 12MHz detuned from the 3 → 4' transition. So some of the atoms end up in the F= 3' state due to off resonant transitions. These atoms decay into the F = 2 or F = 3 ground states. The repump laser re-excites the F = 2 state atoms to the F = 3' state. Without the presence of the repump, the atom number will decrease to zero.







At t_1 the repump laser is turned off. The number of trapped atoms decays to zero. Once the repump laser is turned back on, the atom number reaches the steady state value.